

⑩ BUNDESREPUBLIK  
DEUTSCHLAND



DEUTSCHES  
PATENT- UND  
MARKENAMT

⑫ Patentschrift  
⑩ DE 198 14 180 C 1

⑤ Int. Cl.<sup>6</sup>:  
H 04 R 25/00  
H 04 R 3/00

②① Aktenzeichen: 198 14 180.7-35  
②② Anmeldetag: 30. 3. 98  
④③ Offenlegungstag: –  
④⑤ Veröffentlichungstag  
der Patenterteilung: 7. 10. 99

Innerhalb von 3 Monaten nach Veröffentlichung der Erteilung kann Einspruch erhoben werden

⑦③ Patentinhaber:

Siemens Audiologische Technik GmbH, 91058  
Erlangen, DE

⑦④ Vertreter:

Epping, W., Dipl.-Ing. Dr.-Ing., Pat.-Anw., 82131  
Gauting

⑦② Erfinder:

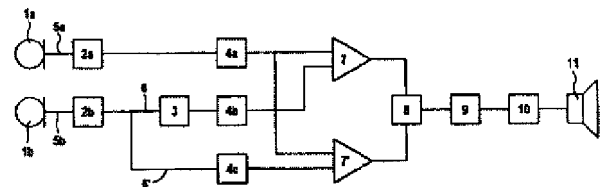
Sigwanz, Ullrich, Dipl.-Inform., 91353 Hausen, DE;  
Zöls, Fred, Dipl.-Ing. (FH), 90592 Schwarzenbruck,  
DE

⑤⑤ Für die Beurteilung der Patentfähigkeit in Betracht  
gezogene Druckschriften:

DE 195 45 760 C1  
DE 40 26 420 A1

⑤④ Digitales Hörgerät sowie Verfahren zur Erzeugung einer variablen Richtmikrofoncharakteristik

⑤⑦ Die Erfindung betrifft ein digitales Hörgerät mit variabler Richtmikrofoncharakteristik, mit einer Signalverarbeitungseinheit (9), einem Lautsprecher (11) und mindestens zwei Mikrofonen (1a, 1b), wobei in mindestens einem Mikrofonsignalpfad (5) ein Sigma-Delta-Konverter (2) sowie ein nachfolgendes Verzögerungselement (3) vorgesehen sind. Ferner betrifft die Erfindung ein Verfahren zum Betrieb eines digitalen Hörgeräts, wobei im Signalpfad mindestens eines Mikrofons eine A/D-Wandlung durch einen Sigma-Delta-Konverter erfolgt und das entsprechende 1-Bit-Signal verzögert wird.



DE 198 14 180 C 1

DE 198 14 180 C 1

2/9/1

DIALOG(R)File 351: Derwent WPI

(c) 2007 The Thomson Corporation. All rights reserved.

0009581170 *Drawing available*

WPI Acc no: 1999-528985/199945

XRPX Acc No: N1999-391896

**Digital hearing aid with variable directional microphone characteristic - has sigma-delta converter and delay element provided by DSP controller or shift register in at least one microphone signal path**

Patent Assignee: SIEMENS AUDIOLOGISCHE TECH GMBH (SIEI)

Inventor: SIGWANZ U; ZOELS F

Patent Family ( 3 patents, 3 countries )

Patent Number	Kind	Date	Application Number	Kind	Date	Update	Type
DE 19814180	C1	19991007	DE 19814180	A	19980330	199945	B
DK 199900424	A	19991001	DK 1999424	A	19990329	200049	E
US 6539096	B1	20030325	US 1999280632	A	19990329	200325	E

Priority Applications (no., kind, date): DE 19814180 A 19980330

Patent Details

Patent Number	Kind	Lan	Pgs	Draw	Filing Notes
DE 19814180	C1	DE	5	1	

**Alerting Abstract DE C1**

The hearing aid includes a signal processing unit , a receiver and at least two microphones. A sigma-delta converter (2) for a A-D conversion and a delay element (3) are provided in at least one microphone signal path (5).

Preferably, the delay element is a DSP control unit or a shift register. An interpolation filter which is formed as a low pass filter is arranged in at least one microphone signal path.

**ADVANTAGE** - Allows sensitive adjustment of directional microphone characteristic with low manufacture complexity.

**Title Terms /Index Terms/Additional Words:** DIGITAL; HEARING; AID; VARIABLE; DIRECTION; MICROPHONE; CHARACTERISTIC; SIGMA; DELTA; CONVERTER; DELAY; ELEMENT; CONTROL; SHIFT; REGISTER; ONE; SIGNAL; PATH

**Class Codes**

International Patent Classification

IPC	Class Level	Scope	Position	Status	Version Date
-----	-------------	-------	----------	--------	--------------

H04R-0025/00	A	I		R	20060101		
H04R-0025/00	C	I		R	20060101		

US Classification, Issued: 381313000, 381312000, 381092000

File Segment: EPI;

DWPI Class: U25; V06; W04

Manual Codes (EPI/S-X): U25-A05; V06-H; W04-G; W04-Y; W04-Y03

### Original Publication Data by Authority

#### Germany

**Publication No.** DE 19814180 C1 (Update 199945 B)

**Publication Date:** 19991007

**Digitales Hoergeraet sowie Verfahren zur Erzeugung einer variablen Richtmikrofoncharakteristik**

**Assignee:** Siemens Audiologische Technik GmbH, 91058 Erlangen, DE (SIEI)

**Inventor:** Sigwanz, Ullrich, Dipl.-Inform., 91353 Hausen, DE

**Zoels, Fred, Dipl.-Ing. (FH), 90592 Schwarzenbruck, DE**

**Agent:** Epping, W., Dipl.-Ing. Dr.-Ing., Patentanwalt, 82131 Gauting

**Language:** DE (5 pages, 1 drawings)

**Application:** DE 19814180 A 19980330 (Local application)

**Original IPC:** H04R-25/00(A) H04R-3/00(B)

**Current IPC:** H04R-25/00(R,A,I,M,EP,20060101,20051008,A) H04R-25/00(R,I,M,EP,20060101,20051008,C)

**Claim:**

- 1. Digitales Horgerat mit variabler Richtmikrofoncharkteristik, mit einer Signalverarbeitungseinheit, einem Horer und mindestens zwei Mikrofonen, **dadurch gekennzeichnet**, dass in mindestens einem Mikrofonsignalpfad (5) ein Sigma-Delta-Konverter (2) sowie ein darauf unmittelbar nachfolgendes Verzogerungselement (3) vorgesehen sind.

#### Denmark

**Publication No.** DK 199900424 A (Update 200049 E)

**Publication Date:** 19991001

**Assignee:** SIEMENS AUDIOLOGISCHE TECH GMBH (SIEI)

**Inventor:** SIGWANZ U

**ZOELS F**

Language: DA  
Application: DK 1999424 A 19990329 (Local application)  
Priority: DE 19814180 A 19980330  
Original IPC: H04R-25/00(A)  
Current IPC: H04R-25/00(R,A,I,M,EP,20060101,20051008,A) H04R-25/00(R,I,M,EP,20060101,20051008,C)

## **United States**

**Publication No.** US 6539096 B1 (Update 200325 E)  
**Publication Date:** 20030325  
**Method for producing a variable directional microphone characteristic and digital hearing aid operating according to the method**

**Assignee:** Siemens Audiologische Technik GmbH, Erlangen, DE (SIEL)

**Inventor:** Sigwanz, Ullrich, Erlangen, DE

**Zoels, Fred, Altenthann, DE**

**Agent:** Schiff Hardin & Waite, US

**Language:** EN

**Application:** US 1999280632 A 19990329 (Local application)

**Priority:** DE 19814180 A 19980330

**Original IPC:** H04R-25/00(A)

**Current IPC:** H04R-25/00(R,A,I,M,EP,20060101,20051008,A) H04R-25/00(R,I,M,EP,20060101,20051008,C)

**Original US Class (main):** 381313

**Original US Class (secondary):** 381312 38192

**Original Abstract:**

A digital hearing aid with a variable directional microphone characteristic, has a signal processing unit, an earphone and at least two microphones, with a sigma-delta converter as well as a delay element following immediately thereafter in at least one microphone signal path. In a method for the operation of such a digital hearing aid, an A/D conversion with the sigma-delta converter ensues in the signal path of at least one microphone and the resulting 1-bit signal is delayed.

**Claim:**

We claim as our invention:

1. 1. A digital hearing aid with a variable directional microphone characteristic comprising:
  - o a plurality of microphones for picking up incoming audio signals and respectively producing at least two analog microphone output signals;
  - o a plurality of microphone signal paths respectively connected to said plurality of microphones, supplied with the respective analog microphone output signals from said plurality of microphones;
  - o at least one of said plurality of microphone signal paths having a sigma-delta converter, which produces a one-bit digital output signal from the

analog microphone output signal therein, immediately followed by a delay element;

- circuitry connected to said plurality of microphone signal paths for obtaining a signal having a directional microphone characteristic, representing a direction from which said incoming audio signals originate, from said signals respectively in said plurality of microphone signal paths;
- a digital signal processor supplied with said signal having said directional signal characteristic, for sampling said signal having said directional microphone characteristic, for producing a processed signal having said directional microphone characteristic therefrom; and
- an earphone connected to said signal processor for converting said processed signal into an audio signal having said directional microphone characteristic and for emitting said audio signal having said directional microphone characteristic.